

## DESCRIPTION OF A SAFETY HOIST GOVERNOR.

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In consequence of numerous accidents occurring in mills, warehouses, &c., where it is necessary to remove materials and goods from one floor or landing place to another by means of a hoist, the inventors of the safety apparatus forming the subject of the present paper, Messrs. Westhead and Baines, ascertained that in the majority of instances the accidents arose from other causes than the breakage of the suspending rope or chain; namely, fracture of the driving wheels, keys becoming loose, straps breaking, or the rope slipping on the pulley when the cage was overweighted, or the removal of the break when the engine was standing. This showed the necessity of introducing a simple safety apparatus, which should be brought into action whenever the velocity of the hoist in its descent attained a limit beyond which it would prove destructive to the machinery and expose the persons employed to imminent peril.

The principle of this invention consists in making the velocity of the hoist its own governor or regulator. This is accomplished by a pair of governor balls, similar to those ordinarily used in steam engines, placed on the top of the hoist, which are put in motion by a friction roller constantly pressing against the guide upon which the hoist works. Should the hoist ever attain a speed above that which it is originally regulated to travel at, the governor immediately releases a latch and sets free a number of serrated cams, which are thrown out against the guides and instantly arrest the descent of the hoist.

Figs. 1 and 2, Plate 69, are a side elevation and plan of the hoist with the safety apparatus; Fig. 3, Plate 70, is an elevation of the governor to a larger scale, and Fig. 4 shows one of the serrated break cams enlarged.

On the top of the hoist A is placed the governor B, receiving motion through the pulley C and bevil wheels from the friction roller D, which is held against the guide E by the spring F. GG are two shafts, one on each side of the hoist, on the ends of

which are fixed the four serrated break cams HH. The cams are kept free from contact with the guides E by the distance rods I attached to the disc K, which is capable of turning freely on the shaft of the pulley C. The latch L fits against a projecting snug on the face of the disc K and holds it stationary. When the hoist is in motion, it will work freely without hindrance from the break cams H, so long as the disc K is held stationary by the latch L; but the instant that the velocity of the hoist exceeds the limit at which it is intended to work, the governor balls flying apart bring the flange of the governor in contact with a projecting pin fixed in the tail of the latch L, Fig. 3, releasing the latch and setting free the cams H, which are thrown out against the guides by means of the springs M acting on the weighted levers N, and instantly stop the further descent of the hoist. The limit of velocity of the hoist is determined by adjusting the sizes of the friction roller D and pulley C.

There is also a further contrivance for ensuring safety in case of the winding rope breaking, consisting of a lever O, the inner end of which is carried under the tail of the latch L, Fig. 3, while the outer end is attached by a cord to the winding rope P. In the event of the rope breaking, the spring R acting on the lever O instantly releases the latch L and sets free the cams H, by which the descent of the hoist is arrested as before.

In this apparatus, the governor for limiting the speed of the hoist, and the contrivance connected with the winding rope as a safeguard against breakage, are entirely independent of each other in their action; while in either case, whether the speed at which the hoist travels be too great or the winding rope break, the same set of cams is instantly thrown into action to arrest the descent of the hoist. The retarding power of the cams is in proportion to the weight of the hoist; for the heavier this is, the greater will be the force exerted by the cams in jamming themselves against the guides. The apparatus thus effectually preserves the machinery from injury in case of accident, and also affords protection and security to the persons employed on the hoist.

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Mr. FOTHERGILL stated that the safety hoist had been in operation satisfactorily for several months with valuable results, and had already been the means of preventing serious accidents particularly from too great speed of descent of the hoist. In large warehouses, hoists were liable to accident from being overloaded, by too many men getting on the hoist thoughtlessly, or putting on too heavy a load of goods and several men getting on besides. This was one of the principal sources of accident, the balance weight being overpowered and the motion unduly accelerated, so that the hoist ran down much faster than intended; but with the contrivance now described the moment this occurred the governor balls flying out with the increase of velocity lifted up the latch and stopped the descent of the hoist instantly, by the powerful grip of the eccentric cams jamming themselves against the guides. The whole apparatus was simple and not liable to derangement; and not expensive, costing not more than £25 altogether for application to any hoist. In many warehouses two or more hoists were required, and at Messrs. Watts' large warehouse in Manchester two of these hoists had been in constant work for some time, which had been found quite satisfactory; and the plan would no doubt be advantageous for many different applications. By means of the small cord connected with the winding rope, if the rope broke, the spring to which the cord was attached instantly released the latch and set free the break cams, stopping the hoist directly; so that in either contingency of the breakage of the rope or the too rapid descent of the hoist, the same apparatus was instantly thrown into action, and completely prevented the further descent of the hoist.

Mr. W. SMITH had seen the safety hoist at work at Messrs. Watts' warehouse, and had tried experiments with it to ascertain the certainty and efficiency of its action; and he considered that if the strength of the parts were amply sufficient to stand the strain, the apparatus would prove thoroughly efficient and satisfactory. He had tried it with the guides greased, and put it to the severest test practicable with heavy loads, and found it quite efficient; and he thought that if the rotation of the governor by friction could be always ensured, the apparatus would answer well, but it must be secure against any slip of the friction roller taking place. The

height to which these hoists were now carried in warehouses was very great, and from the increased danger of accident he thought this safety apparatus should be added to all ; it was of great value for preventing accident not only from breakage of the rope but in case of the key coming out of the lifting pulley or the break of the pulley not acting, and these were more frequent causes of accident than the rope breaking. For railway hoists also, where the weight moved was very great, the apparatus might no doubt be applied with much advantage.

In the construction of the hoist gear he thought that, instead of trusting to the adhesion of the friction roller for driving the governor, the use of a toothed wheel and rack with shallow teeth well rounded would be preferable, as more secure against slipping. It also occurred to him to suggest that the four ball governor would be more applicable than the ordinary governor, as the whole operation was so momentary ; and since the velocity of descent would increase rapidly when the hoist had begun to fall, it was desirable to get as instantaneous an action as possible to prevent its falling beyond a very short distance.

The CHAIRMAN remarked that the four ball governor might be placed upon the horizontal shaft and driven direct by the friction roller, thus avoiding the intermediate friction belt, and would then be more direct in its action.

Mr. C. W. SIEMENS thought it an excellent idea to arrest the motion of a falling body by the action of a governor, and its application to a hoist would give an important additional security against accident. With regard to the mode of action of the cams, he considered they were put in action entirely by the spiral springs, and that the weights upon the cam levers should be dispensed with ; as the whole apparatus fell together, both the weights and the hoist would be accelerated equally, without any tendency for the weights on the levers to change their relative position unless some resistance of friction retarded the motion of the hoist at starting, so as to allow the small weights to overrun the rest of the apparatus to a sufficient extent for throwing the cams into action.

Mr. FOTHERGILL said he had recommended the application of the spiral springs in order to make the break levers more prompt and

certain in action ; as there could be no doubt that the whole hoist would be acted upon by gravity equally with the small weights. In reference to the mode of communicating motion to the governor, the apparatus had at present been constructed with a plain friction roller running against the guide, as shown in the drawings ; but a rack slightly indented would certainly be more perfect, though involving the additional expense of the rack extending the entire height of 60 or 80 feet in several instances. The hoist was equally safe with heavy and with light loads, for the greater the load the greater was the holding power of the cams, in consequence of their eccentric form ; and he thought it was very desirable that the apparatus should be added to all hoists, as an effectual means of preventing the accidents to which they were now liable.

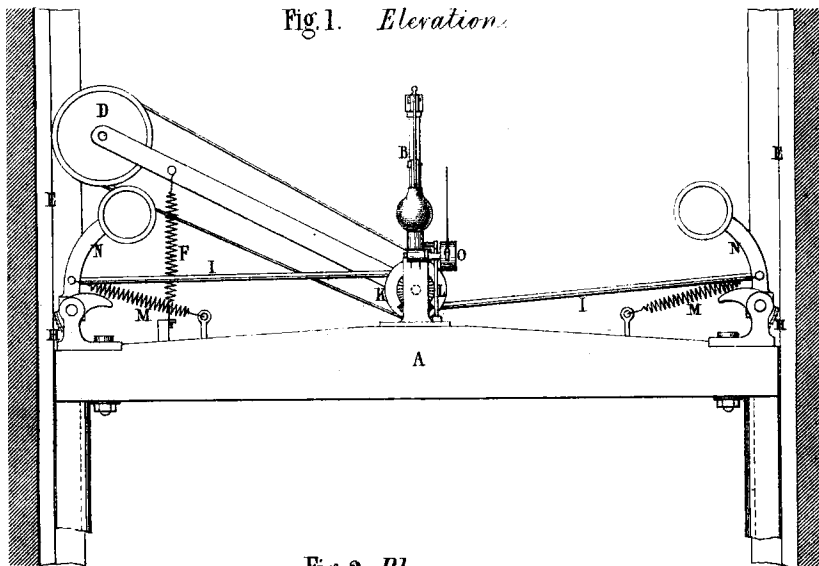
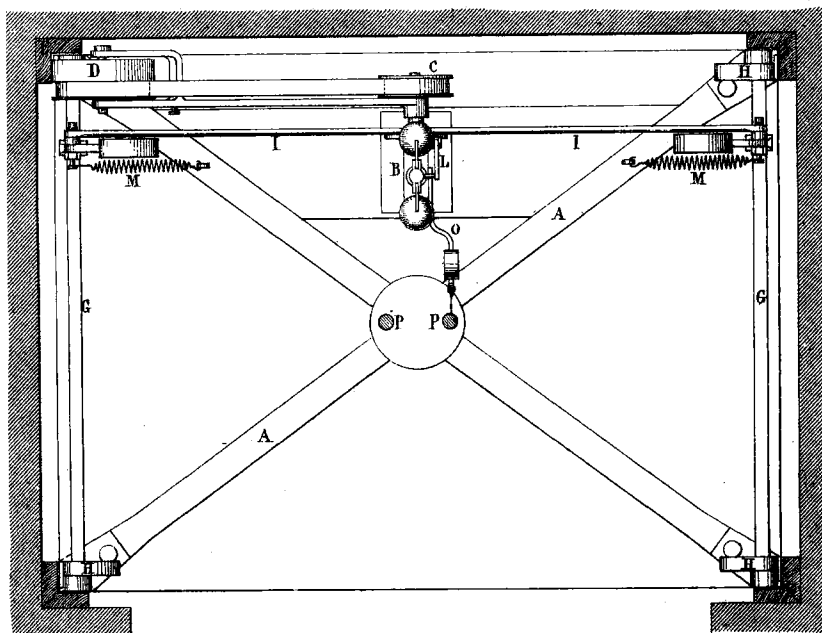
Mr. SAMPSON LLOYD thought the safety apparatus might be applied with great advantage to mines, where the number of cases for its application would be far greater than in warehouses ; the importance of an efficient safety apparatus was much greater in mines, from the increased depth and the greater risks that were incurred. The application of the plan would of course require cages and guides in the shafts, but these were now being generally adopted on account of their advantages in working.

Mr. FOTHERGILL said the plan would be quite applicable to mines ; and he would be happy at a future meeting to give a description and model of its application to railway hoists, which was being carried out.

The CHAIRMAN proposed a vote of thanks to Mr. Fothergill for his paper, which was passed.

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The following Paper, by Mr. Joseph Tomlinson, of Cardiff, was then read :—

Fig 1. *Elevation.*Fig 2. *Plan.*Scale  $\frac{1}{20}^{th}$ .

Ins. 12 9 6 3 0 1 2 3 4 5 Feet.

SAFETY HOIST GOVERNOR.

Plate 70.

Fig. 3.  
Elevation  
of  
Governor.

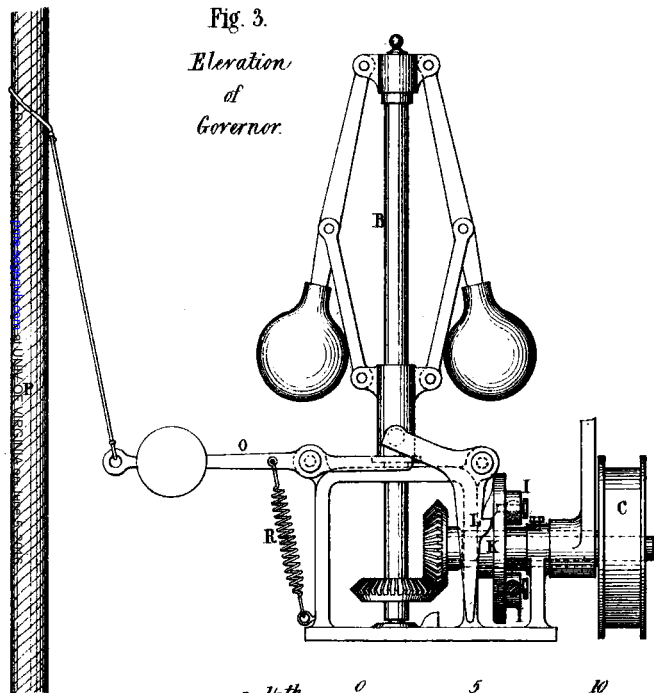
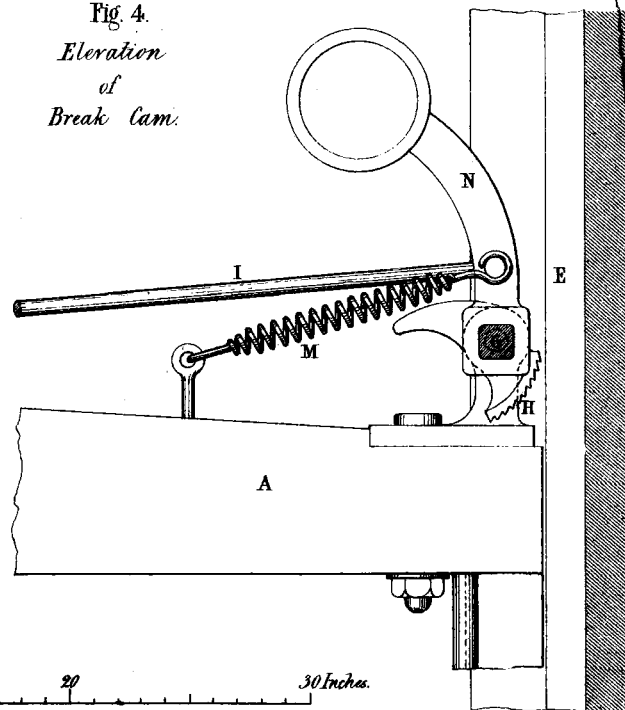


Fig. 4.  
Elevation  
of  
Break Cam.



Scale  $\frac{1}{8}$ th.

0 5 10 20 30 Inches.

(Proceedings Inst. M.E. 1858. Page 269.)